



Figure 2-30. Float Chamber Components, Exploded View.

stream in either direction. The latter meter shows total delivery and subtracts the amount defueled from the dispensing hose and pipeline at the end of the refueling operation to show the actual amount of fuel delivered to the aircraft.

2-25. Testing and Calibrating Meters. Since moving parts are subject to wear, and solids can accumulate, periodic calibration is necessary. Check and calibrate meters installed in fixed petroleum plants and systems according to the method and frequency outlined in chapter 10.

a. Certified master meters are used in meter calibrations by connecting hoses from the hydrant outlet to the master meter and from the master meter to a tank truck or servicing vehicle. Master meters must be calibrated after a flow log of 1,200,000 gallons as indicated on the totalizer (or every 6 months, whichever occurs first). Calibration is made at normal flow rates and operating pressures.

b. Meters are considered satisfactory for further operation when: for any one predetermined flow rate and calibration setting between 20 and 100 percent of rated capability, the error of the meter in normal flow direction does not exceed 0.2 percent of actual quantity delivered (1.2 gallons in a 600 gallon test); for other flow rates in the range from 20 to 100

percent of rated capacity, and without readjustment of calibration setting, the error of the meter in normal flow direction does not exceed 0.2 percent and in reverse flow does not exceed 0.3 percent of the actual quantity delivered.

2-26. Meter Adjustment. When a check of the master shows amount of fuel delivered is different from amount indicated, the installed meter may have to be adjusted. In some instances, meter adjustment is made only by replacement of complete "Change-Gear" sets. Meters of this type (and meters for which proper adjustment cannot be made because of wear) are removed and replaced. The old meter is returned for overhaul. Adjust others according to the manufacturer's instructions or as follows:

a. For Pittsburgh Meters:

(1) Remove the wire seal from the two fillister head screws holding the cover plate over the counter adjuster.

(2) Place a screw driver in the slot on the counter adjuster, and turn clockwise to increase fuel flow through the meter (counterclockwise to decrease it.) Graduations as indicated on the counter adjuster represents about 0.1 gallon.

b. For Neptune Meters:

(1) Remove seal from screws holding the top

cover plate to meter base.

(2) Remove the four screws holding the top cover plate. Slide plate back about 1/4-inch to free it from the turned-over edge of the dial face, and lift off.

(3) Lift gear changer and adjust for fuel flow through the meter according to the manufacturer's instructions.

(4) There is a series of holes in the plate into which the guide pin enters at different settings. Altering the setting by one hole changes the calibration about 0.15 percent or 0.15 gallons per 100 gallons.

c. For Brodie Meters:

(1) Calibration and fuel flow adjustments of Brodie meters are made according to manufacturer's instructions.

(2) After completing the calibration of meters, the cover plates will be fastened securely to prevent tampering.

d. For Granco Meters:

(1) Remove screws holding the adjustment cover cap over the precision adjustment dial.

(2) Place a screw driver in the slot in the precision adjustment dial pointer screw and adjust for fuel flow through the meter according to the manufacturer's instructions.

e. For Smith Meters:

(1) The SA-60/R uses levers for adjusting.

(2) Adjust the fuel flow according to the manufacturer's instructions.

(3) Course adjustment—1 notch equals 138.8 cubic inches per 100 gallons.

(4) Fine adjustment—1 notch equals 11.5 cubic inches per 100 gallons.

(5) Pull the levers out to lower the level of fuel in the prover tank, or push the levers in to raise the level of fuel in the prover tank.

2-27. Maintenance of Meters:

a. Maintenance on meters in the field is limited to minor repairs (such as replacement of gaskets, counters, and packing glands). Disassembly of a meter must never be undertaken unless personnel are experienced in repair of this type of equipment. Also, complete instructions for disassembly and assembly must be available. Do not take meter apart until it has been determined that the trouble is in the meter.

b. Gaskets used on meters are usually of a special material and thickness. When replacing gaskets, care must be taken to obtain gaskets of the proper type and thickness, preferably the manufacturer's gaskets; this guards against variations in the clearance between rotors, disks, and measuring chamber. Such variations can result in meter inaccuracy.

c. Operator personnel will remove meter drain plugs and drain water or sediment from the meter weekly. If a meter has been idle for a prolonged period, remove plug and drain the meter before placing it in service.

NOTE: Drain lines should also have a valve installed to permit easy draining.

2-28. Troubleshooting. Before removing a meter from the fuel system, all possible causes of the meter malfunctioning should be checked to determine whether the meter is the cause of the trouble:

a. Erratic Recording. Meters are normally constant in their action. They constantly measure over, under, or accurately, whichever the case may be. It is not the natural performance of a meter to go erratic all at once unless the meter is operating under:

(1) Dirty conditions.

(2) Poor air elimination.

(3) Liquid locked vent line.

(4) Great variation in velocity.

(5) Excessive head. To eliminate erratic meter operation, first check pump suction piping, valves, and connections for air leaks; proper seating of valves; dirty strainers or filters; and operation of air eliminators, where installed. Check counter drive for slipping gears or gears not meshing properly. Remove, clean and check meter only as a last resort.

b. Slow Meters. A slow meter is often misunderstood to be a dirty meter. A meter that is sufficiently dirty generally stops and locks rather than slows down. Therefore, check the possibility of defective valves, dirty strainer, or filter-restricted line or hose. Before working on meter determine whether the trouble is in the meter.

c. Ineffective Adjustment. When adjustment is ineffective, the usual cause is a dirty meter or air condition in the liquid. Therefore, check for possible line leaks and condition of filters and strainers. If final diagnosis shows the meter is at fault, the meter adjuster should be removed, checked, and replaced if damaged. Remove and clean meter.

SECTION F—MANUAL VALVES

2-29. Plug Valves:

a. Lubricated Plug Valves. Plug valves, MIL-V-12003, primarily have three components: the housing provides a leak proof seat for the plug; the tapered plug is seated in the housing and can be positioned to block the flow of fuel or pass the full capacity of the line; and a device raises the plug away from its seat to permit ease of turning. Plug valves are divided into two classes: lubricated and nonlubricated.

(1) Using Valves. Lubricated plug valves are used as stop (block) valves in various parts of the system, such as in piping to hydrant outlet, between pump and pump header, and between pump header and filter separator.

(2) Operating Valves. The lubricant in a lubricated plug valve serves three functions. The primary function is to lift the tapered plug away from its seat. The principle involved in the operation is illustrated in figure 2-31. The second purpose of the lubricant is to form a high pressure seal between the plug and seat. Two pieces of metal clamped together to form a pressure vessel will not hold pressures in excess of 100 psi. When coated with lubricant, these surfaces will hold pressures in excess of 30,000 psi. The third function of the lubricant is to lubricate the surface of the plug for ease in turning. A typical lubricated plug valve is shown in figure 2-32.

(3) Maintenance.

APPENDIX B-2

**AIR FORCE MANUAL 85-16,
FILLSTAND METER CALIBRATION**

10-21. Electrical and Static Grounding:

★a. Ground Cables (Tank car, and tank truck unloading area, truck fillstands, fuel dispensing areas, piers, wharves). Inspect the ground cable connection points; wires and clips for condition. Replace the cables immediately if insulation or wires are damaged or broken and repair any damaged cable-ground connections. FREQUENCY: QUARTERLY.

★b. Ground Connections (Bulk Storage Aboveground Tanks):

(1) Visually inspect ground connections around periphery of base, tighten and clean any loose or corroded connection. FREQUENCY: QUARTERLY.

(2) (Floating Roof Tanks Only). Visually inspect the ladder bonding connections for tightness and condition of cable. FREQUENCY: QUARTERLY.

c. Rail Car Offloading Spur:

(1) Visually inspect rail joint bonding to ascertain that jumpers are intact at each joint. FREQUENCY: QUARTERLY.

(2) Visually inspect insulating rail joints for condition to make sure that fuel off-loading area is insulated from main rail systems. FREQUENCY: MONTHLY.

d. Disconnect Switches. (Power Control Center, Pumprooms, Piers, Unloading Area). Operate the disconnect switches several times to ensure ease of opening and closing circuit. Inspect the fuse clips, switch blades, and connections for condition and security of contacts. FREQUENCY: MONTHLY.

★e. Starters and Contractors (Power Control Center, Pumprooms, Piers, Loading Areas). Inspect all of the starters, contractors, and circuits. Inspect the contacts for local heating and condition of contact surface. Check the overload heaters and coils for local heating or discoloration. If roughness or pitting is evident, contacts will be cleaned by methods recommended by the electrical work center. FREQUENCY: ANNUALLY.

★f. Wiring and Fuse Boxes. (Same as above.) Inspect all exposed wire, conduit, fuse boxes, and switches for safe condition. FREQUENCY: ANNUALLY.

g. Ground Conductors. (See chapter 1, sections F and G.) Test the resistance of all of the ground conductors. Record test results. FREQUENCY: ANNUALLY (Electric Shop)

h. Emergency Switches. Check for proper operation by actually operating all emergency stop switches. FREQUENCY: QUARTERLY.

NOTE: Visual inspections and operational checks will be performed by LFM personnel. Actual ohm continuity, multimeter testing, and marking, will be done by qualified electric shop personnel.

10-22. Meters. Meters must be calibrated at intervals and in the way prescribed below. Calibration of installed meters is the responsibility of the LFM shop. The LFM shop will maintain meter calibration records on installed meters using embossing tape or stencil to include calibration due date and gallons dispensed. Cal-

ibration of mobile unit meters is the responsibility of the motor vehicle maintenance shop. The responsibility for calibration of installed meters may be delegated by base civil engineer to the motor vehicle maintenance shop whenever considered advantageous to the Air Force, and will be done by a Memorandum of Agreement:

★a. Calibration should be done each year.

b. Any time when improper performance is suspected; when unusual sounds or peculiar register actions develop; and after repairs and inspections that might affect their performance in any way.

c. Those meters with drain plugs will be drained of water and sediment once a week. FREQUENCY: WEEKLY. (Operator Maintenance.)

10-23. Signs and Markings:

a. Location of signs and markings should be recorded to facilitate ease of inspection. Check for condition, adequacy, possibility of deleting obsolete signs, and necessity of additional signs. FREQUENCY: MONTHLY.

b. Make sure installed fuel facilities (such as pipelines, tanks, fillstands, etc.) are properly marked according to current MIL-STD-161. FREQUENCY: MONTHLY.

NOTE: All safety or warning signs located in and around fuel storage and operating areas will conform to information outlined in AFOSH Standards, and TO 37-1-1. Warning signs for these areas are worded as follows: NO OPEN FLAME OR IGNITION SOURCE PERMITTED BEYOND THIS POINT. The sign is placed on the security fences surrounding the area. In those instances where security fences are not provided, signs will be posted 50 feet from the diked area or fuel vents of underground storage tanks. The number and location of these signs will be determined by the base civil engineer.

★10-24. Pressure Gages. Each pressure gage (calibrate differential pressure gauges according to manufacturer's recommended schedule) will be tested and calibrated at least once a year, or more often as indicated by obvious malfunctioning (such as erroneous readings). Testing and calibration should be done by the civil engineer work center or base precision measurement equipment laboratory (PMEL), using embossing tape or stencil including calibration due date for maintenance of calibration records. Piston type differential pressure gages do not require calibration. FREQUENCY: ANNUALLY.

10-25. Cathodic Protection. Cathodic protection systems are maintained by electric shop personnel. General information is in chapter 9. Maintenance of cathodic protection systems is covered in AFM 85-5. FREQUENCY: AS REQUIRED (Electric Shop).

10-26. Tank Entry Safety Equipment. Tank entry safety equipment for personnel entering hazardous

Chapter 7

MECHANICAL SYSTEMS (CONVENTIONAL TYPE)

SECTION A—GENERAL

7-1. General Information. Mechanical petroleum storage and dispensing systems consist primarily of tanks located either on the surface or underground; and an electrically operated pumping system and piping installations for the receipt of fuel from tank cars or tank trucks and the issue of fuel to tank trucks. Receipt of petroleum will ordinarily be by force of gravity to underground tanks, and by pump for surface tanks. Issue of product is made by an electrically operated pumping system, remotely controlled from a central control system. The electrical system has adequate safety features as an integral part of design and construction. If properly maintained and operated, the system will present no hazardous problems. The piping system is simple in design and requires only a reasonable amount of attention and maintainance to prevent dangerous operating conditions. For specific description and maintenance details of mechanical system components, refer to other paragraphs as noted below:

- a. Tank cleaning preparations (chapter 11).
- b. Tank truck and transport unloading (chapter 2, section A).
- c. Pumps (paragraph 2-4).
- d. Vapor lock (paragraph 2-4).
- e. Belowground and aboveground storage (paragraph 2-7).
- f. Plug valves (paragraph 2-29).
- g. Line strainer (paragraph 2-33).
- h. Air eliminator (paragraph 2-34).
- i. Pressure relief valve (paragraph 4-11).

NOTE: Aqua systems are not permitted for dispensing aviation fuels. Aviation fuels must be dispensed by a mechanical system.

SECTION B—MOTOR VEHICLE FUELING SYSTEMS

7-2. Motor Vehicle Fueling System. Motor vehicle fueling systems (figure 7-1) are usually designed to dispense one grade of fuel from an underground storage tank through a service station type dispenser to a vehicle, or to a multiple outlet system serving several dispensing outlets. Separate systems are used for each grade of fuel dispensed. The dispensing units are purchased separately for each base. Therefore, your base could possibly have several different name brands of dispensing units installed. Some dispensing units are plain in appearance, and they record only the number of gallons delivered. Other units of more modern design show the price as well as the number of gallons. The dispensing rate is usually based on 10-15 gpm per outlet for passenger cars and up to 25 gpm per outlet for trucks and buses. The only source of detailed information that is available on the various dispensers are the manufacturer's instructions. Due to the numerous models and types of dispensers that are available, only general information on them is covered in this section.

7-3. System Components:

a. **Pumps.** The pump assembly used can be either located in the dispenser unit itself or it can be of the submergible type that is located in the tank. The actual working pressure varies depending on the model and type of dispenser used.

b. **Meters:**

(1) **Description.** The meter is generally a four cylinder positive displacement type designed especially for use in gasoline dispensing pumps. Under normal use it requires very little attention.

(2) **Maintenance and Repair.** The meters are kept according to the manufacturer's instructions. Repair or replacement of parts is usually handled by the manufacturer.

(3) **Test and Adjustment Meter:**

(a) To ensure efficient operation on newly installed pumps, all air must be completely expelled by circulating 20 or more gallons of liquid through them. After this has been done, the built-in air release ensures efficient and accurate operation.

(b) Generally, there is no adjustment provided in the computer for correcting measurement; if any adjustment is necessary, it is normally made in the meter. The meter is tested with liquid in measures approved by the Department of Weights and Measures before being shipped and is then sealed as correct. After installing, no adjustment should be necessary. Meters should be calibrated at intervals described in chapter 10 using a 5-gallon measurer certified by the local Department of Weights and Measures.

(c) To adjust, follow the manufacturer's instructions.

(d) Meters are considered satisfactory for further operation when the error of the meter does not exceed 0.2 percent of the total quantity delivered. This will amount to 2 to 3 cubic inches on a 5-gallon test run. (0.2 percent of 5 gallons equals 2.31 cubic inches.)

(4) **Check and Relief Valve Assembly.** The check and relief valve functions in two ways. It holds liquid in the discharge portion of the unit and also relieves any excess pressure from expansion of liquid above check valve.

SECTION C—TRUCK FILLSTANDS

7-4. General Information. Air Force bases handling bulk petroleum products will require facilities for issuing fuel to refueler trucks or tank trucks. The fuel products to be dispensed are usually JP-4, avgas, mogas, and diesel fuel. The number of simultaneous loadings required is determined by the command having jurisdiction from a study of the mission and operation requirements. A minimum of one and a maximum of four outlets will be provided for each grade of fuel.

7-5. Types of Stands. Bottom loading stands, top loading stands and combination top and bottom loading stands will be provided as follows:

APPENDIX B-4

**AIR FORCE TECHNICAL ORDER 37A-1-101,
SECTION VIII, METER CALIBRATION**

SECTION VIII

METER CALIBRATION

8-1. GENERAL.

8-2. The procedures established in the section provide for the calibration of meters used for measuring fuel or oil dispensed from refueling vehicles (trucks, trailer, hose carts, etc.).

8-3. METHOD.

8-4. Calibration of fuel and oil meters will be accomplished by using a calibrated and certified master meter (T.O. 33A6-7-13-1).

NOTE

Activities not possessing master meters may use a prover tank (T.O. 33A6-2-3-1) as alternate method.

8-5. REQUIREMENTS.

8-6. Meter calibration will be accomplished under normal operating pressures and at flow rates prescribed in the applicable technical directive for the end item of equipment.

8-7. Liquid used to test and calibrate meters should be near the same temperature of liquid to be measured. When calibrating meters during temperature extremes, it may be necessary to pump fuel from an underground storage system to obtain liquid with a temperature compatible with adjusting the meters.

8-8. In accordance with Model Installation Program (MIP) proposal 87LCSA011AGLG, refueling vehicles/equipment receiving fuel from a calibrated metered source are no longer required to have their fuel meters calibrated. Refueling vehicles/equipment receiving fuel from a non-calibrated meter or non-meter source must still have their meters calibrated annually.

8-9. Meters should also be checked and calibrated at any time when their performance is doubtful, when unusual sounds or peculiar register actions develop in a meter, or immediately following repairs and inspections which might in anyway affect their performance.

8-10. Meters are considered satisfactory for further operation when tests indicate that meter calibration is within the limit of 1/2 gallon plus or minus for each 100 gallons dispensed.

8-11. ADJUSTMENTS.

8-12. Meter adjustments will be accomplished as outlined in Section VII of equipment technical manuals or technical manuals applicable to the meters.